

requiring unauthorized persons to keep out of the construction area shall be posted on the fencing. At the minimum, posting shall be on all fenced sides of the project and spaced one sign every 90 m (300 feet). > See also Section 08

c. For areas of minimal public exposure, fencing is not required but signs, warning of construction hazards, shall be posted.

04.A.05 Temporary sleeping quarters shall be heated, ventilated, lighted, and maintained in a clean and safe condition.

04.A.06 Unless otherwise indicated, throughout this manual lumber dimensions are given in nominal sizes.

## SECTION 5

### PERSONAL PROTECTIVE AND SAFETY EQUIPMENT

#### 05.A GENERAL

05.A.01 Responsibilities.

a. Based on hazard assessments, employers shall select, and have each affected employee use, personal protective equipment (PPE) that will protect the employee from hazards.  
> See also 06.A.02

b. Employers shall communicate PPE decisions to each affected employee and select PPE that properly fits each affected employee.

c. Employees shall use any PPE that may be required to maintain their exposure within acceptable limits.

05.A.02 Employees shall be physically able and medically determined qualified to use the personal protective and safety equipment that may be required in their job duties.

05.A.03 Employers shall ensure users of personal protective and safety equipment are trained to know the following: when PPE, and what PPE, is necessary; how properly to don, doff, adjust, and wear PPE; limitations of the PPE; and proper care, inspection, testing, maintenance, useful life, storage, and disposal of the PPE.

a. Each affected employee shall demonstrate an understanding of this training and the ability to use PPE properly before being allowed to perform work requiring the use of PPE.

b. When the employer has reason to believe that any affected employee who has been trained does not have the understanding and skill required of the training, the employer shall retrain the employee.

c. The employer shall verify that each affected employee has received and understood the required training by a written certification that identifies the name of each employee trained, the date(s) of the training, and the subjects taught.

05.A.04 A copy of the manufacturer's use, inspection, testing, and maintenance instructions shall be maintained with the personal protective and safety equipment.

05.A.05 Personal protective and safety equipment shall be tested, inspected, and maintained in serviceable and sanitary condition as recommended by the manufacturer.

- a. Defective or damaged equipment shall not be used.
- b. Before being stored or reissued to another person, equipment shall be cleaned, disinfected, inspected and repaired.

05.A.06 When employees provide their own equipment, the employer is responsible for assuring its adequacy in protecting against the hazard and its state of repair.

05.A.07 Minimum requirements.

- a. Employees shall wear clothing suitable for the weather and work conditions: the minimum for field work shall be short sleeve shirt, long trousers, and leather or other protective work shoes or boots.
- b. Protective equipment shall be of heat/fire-resistive material when conditions require protection against such hazards.

05.A.08 Protective footwear, such as rubber boots, protective covers, ice clamp-ons, and steel-toed safety boots, shall be worn by all persons exposed to hazards to the feet (including, but not limited to, puncture, slipping, electrical, or chemical hazards).

a. For all activities in which Corps or contractor personnel or official visitors are potentially exposed to foot hazards, the applicable position/activity hazard analysis, accident prevention plan, or project safety and health plan shall include an analysis of, and prescribe specific protective measures to be taken for, reducing foot hazards.

b. Footwear providing protection against impact and compressive forces, conduction hazards, electrical hazards, and sole puncture shall meet the applicable requirements of ANSI Z41: footwear providing protection against impact and compression hazards shall be rated as I75 and C75.

c. Unexploded ordnance (UXO) sweep personnel shall have no metal parts in or on their footwear.

05.A.09 Miners' lights and flashlights used around explosives and in atmospheres likely to contain explosive vapors, dusts, or gases shall be approved by the Mine Safety and Health Administration (MSHA) or National Institute for Occupational Safety and Health (NIOSH) for use in such locations.

05.A.10 Persons involved in activities which subject the hands to injury (e.g., cuts, abrasions, punctures, burns, chemical irritants, toxins, vibration, and forces which can restrict blood flow) shall use hand protection appropriate for the hazard.

05.A.11 Persons exposed to vehicular or equipment traffic, including signalpersons, spotters, or inspectors, shall wear belts or apparel marked with a reflectorized or high-visibility material.

05.A.12 Overhead protection shall be provided where the public or workers are subject to injury from falling objects.

05.A.13 Persons shall not be permitted to work above or in positions exposed to protruding reinforcing steel or other impalement hazards unless provisions have been made to eliminate the impalement hazard.

## 05.B EYE AND FACE PROTECTION

05.B.01 Persons shall be provided with eye and face protective equipment, as outlined in Table 5-1, when machines or operations present potential eye or face injury from physical, chemical, or radiation agents.

a. All eye and face protection equipment shall meet the requirements of ANSI Z87.1, *Practice for Occupational and Educational Eye and Face Protection*, and bear a legible and permanent "Z87" logo to indicate compliance with the standard.

b. Eye and face PPE shall be distinctly marked to facilitate identification of the manufacturer.

c. Employees shall use eye protection providing side protection when exposed to hazards from flying objects.

05.B.02 When required by this regulation to wear eye protection, persons whose vision requires the use of corrective lenses in eyeglasses shall be protected by one of the following:

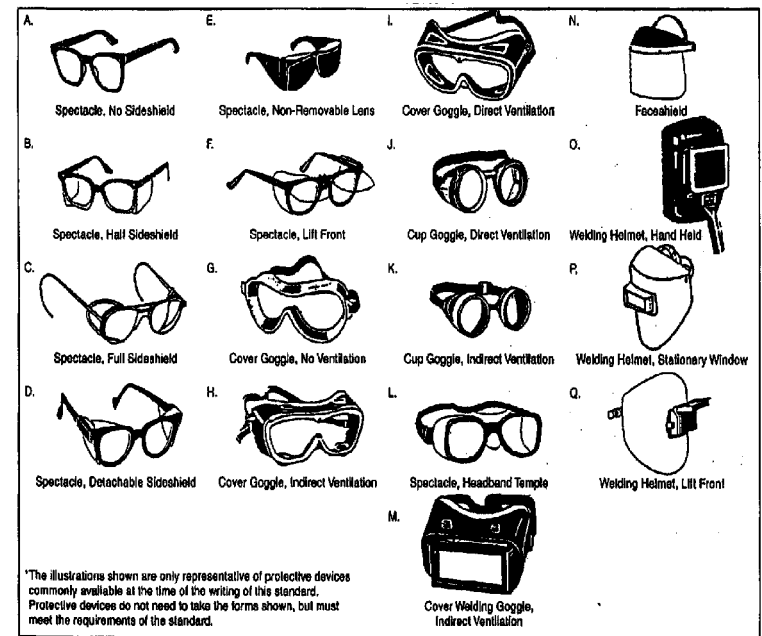
- a. eyeglasses with protective lenses providing optical correction,
- b. goggles that can be worn over corrective lenses without disturbing the adjustment of the spectacles, or
- c. goggles that incorporate corrective lenses mounted behind the protective lenses.

05.B.03 Personnel working in other than administrative functions who are considered blind in one eye shall wear safety spectacles with side shields while on the job.

05.B.04 Operations that require the use of, or exposure to, hot or molten substances (e.g., babbitting, soldering, pouring or casting of hot metals, handling of hot tar, oils, liquids, and molten substances) shall require eye protection, such as goggles, with safety lenses and screens for side protection, or face masks, shields, and helmets giving equal protection. Lens mountings

TABLE 5-1

## EYE AND FACE PROTECTOR SELECTION GUIDE



### NOTES:

- (1) Care shall be taken to recognize the possibility of multiple and simultaneous exposure to a variety of hazards. Adequate protection against the highest level of each of the hazards must be provided.
- (2) Operations involving heat may also involve optical radiation. Protection from both hazards shall be provided.
- (3) Faceshields shall only be worn over primary eye protection.
- (4) Filter lenses shall meet the requirements for shade designations in Table 1.
- (5) Persons whose vision requires the use of prescription (Rx) lenses shall wear either protective devices fitted with prescription (Rx) lenses or protective devices designed to be worn over regular prescription (Rx) eyewear.

- (6) Wearers of contact lenses shall also be required to wear appropriate covering eye and face protection devices in a hazardous environment. It should be recognized that dusty and/or chemical environments may represent an additional hazard to contact lens wearers.
- (7) Caution should be exercised in the use of metal frame protective devices in electrical hazard areas.
- (8) Refer to Section 6.5, Special Purpose Lenses.
- (9) Welding helmets or handscreens shall be used only over primary eye protection.
- (10) Non-sideshield spectacles are available for frontal protection only.

TABLE 5-1, continued

AMERICAN NATIONAL STANDARD Z87.1-1969  
SELECTION CHART

		ASSESSMENT SEE NOTE (1)	PROTECTOR TYPE	PROTECTORS	LIMITATIONS	NOT RECOMMENDED
IMPACT	Chipping, grinding, machining, masonry work, riveting, and sanding.	Flying fragments, objects, large chips, particles, sand, dirt, etc.	B,C,D, E,F,G, H,I,J, K,L,N	Spectacles, goggles faceshields  SEE NOTES (1) (3) (5) (6) (10) For severe exposure add N	Protective devices do not provide unlimited protection.  SEE NOTE (7)	Protectors that do not provide protection from side exposure. SEE NOTE (10)  Filter or tinted lenses that restrict light transmittance, unless it is determined that a glare hazard exists. Refer to OPTICAL RADIATION.
	Furnace operations, pouring, casting, hot dipping, gas cutting, and welding.	Hot sparks  Splash from molten metals  High temperature exposure	B,C,D, E,F,G, H,I,J, K,L,N  *N  N	Faceshields, goggles, spectacles *For severe exposure add N  SEE NOTE (2) (3) *Faceshields worn over goggles H,K  SEE NOTE (2) (3) Screen faceshields, Reflective faceshields.  SEE NOTE (2) (3)	Spectacles, cup and cover type goggles do not provide unlimited facial protection.  SEE NOTE (2)    SEE NOTE (3)	Protectors that do not provide protection from side exposure.
CHEMICAL	Acid and chemicals handling, degreasing, plating	Splash  Irritating mists	G,H,K  *N  G	Goggles, eyecup and cover types  *For severe exposure, add N  Special purpose goggles	Ventilation should be adequate but well protected from splash entry  SEE NOTE (3)	Spectacles, welding helmets, handsheilds
	Woodworking, buffing, general dusty conditions.	Nuisance dust	G,H,K	Goggles, eyecup and cover types	Atmospheric conditions and the restricted vent- ilation of the protector can cause lenses to fog. Frequent cleaning may be required.	
OPTICAL RADIATION	WELDING:  Electric Arc		O,R,Q	TYPICAL FILTER LENS SHADE PRO- TECTORS SEE NOTE (9)  10-14 Welding Helmets or Welding Shields	Protection from optical radiation is directly related to filter lens density. SEE NOTE (4). Select the darkest shade that allows adequate task performance.	Protectors that do not provide protection from optical radiation. SEE NOTE (4)
	WELDING:  Gas		J,K,L, M,N,O, P,Q	SEE NOTE (9)  4-8 Welding Goggles or Welding Faceshield	SEE NOTE (3)	
	CUTTING			3-6		
	TORCH BRAZING			3-4		
	TORCH SOLDERING		B,C,D, E,F,N	1.5-3 Spectacles or Welding Faceshield		
	GLARE		A,B	Spectacle  SEE NOTE (9) (10)	Shaded or Special Purpose lenses, as suitable.  SEE NOTE (8)	

TABLE 5-2

REQUIRED SHADES FOR FILTER LENSES AND GLASSES IN  
WELDING, CUTTING, BRAZING, AND SOLDERING

OPERATION	SHADE NUMBER
Soldering	2
Torch Brazing	3 or 4
Cutting (light) up to 1 inch	3 or 4
Cutting (medium) 1 to 6 inches	4 or 5
Cutting (heavy) 6 inch or more	5 or 6
Gas welding (light) up to 1/8 inch	4 or 5
Gas welding (medium) 1/8 to 1/2 inch	5 or 6
Gas welding (heavy) 1/2 inch or more	6 or 8
Atomic hydrogen welding	10 - 14
Inert-gas metal-arc welding (nonferrous) - 1/16 to 5/32 inch electrodes	11
Inert-gas metal-arc welding (ferrous) - 1/16 to 5/32 inch electrodes	12
Shielded metal-arc welding - 1/16 to 5/32 inch electrodes	10
Shielded metal-arc welding - 3/16 to 1/4 inch electrodes	12
Shielded metal-arc welding - 5/16 to 3/8 inch electrodes	14
Carbon arc welding	14

shall be able to retain in position all parts of a cracked lens.

05.B.05 Operations that require handling of harmful materials (e.g., acids, caustics, hot liquids, or creosoted materials) and operations where protection from gases, fumes, and liquids is necessary shall require the wearing of goggles with cups of soft pliable rubber or suitable face masks or hoods that cover the head and neck, and other protective clothing appropriate to the hazards involved.

05.B.06 Operations where protection from radiant energy with moderate reduction of visible light is necessary, including welding, cutting, brazing, and soldering, shall require eye and face protection suitable to the type of work, providing protection from all angles of direct exposure, and with lenses of the appropriate shade. > See **Table 5-2**

05.B.07 Glare-resistant glasses with a minimum ultraviolet filter rating of 96% filtration at 400 nanometers shall be worn when conditions require protection against glare.

05.B.08 Tinted or automatically darkening lenses should not be worn when work tasks require the employee to pass from brightly to dimly lighted areas.

## 05.C HEARING PROTECTION AND NOISE CONTROL

05.C.01 Sound-pressure level limits.

a. Department of Defense (DoD) personnel shall be provided protection against the effects of hazardous noise exposure whenever sound-pressure levels exceed 85 dB(A) steady-state expressed as a time-weighted average (TWA) or 140 dB(A) impulse.

b. Non-DoD personnel shall be provided, as a minimum, protection against the effects of hazardous noise exposure whenever the sound-pressure level exceeds the limits and/or exposure times specified in Table 5-3.

05.C.02 When personnel are subjected to sound-pressure levels exceeding the limits specified below, feasible engineering or administrative controls shall be used. When such controls fail to reduce sound-pressure levels within the specified limit, PPE shall be selected, evaluated, provided and used in accordance with the hearing conservation program.

**TABLE 5-3  
PERMISSIBLE NON-DoD NOISE EXPOSURES**

Duration/day (hours)	Sound-pressure level dB(A) slow response
8	90
6	92
4	95
3	97
2	100
1-1/2	102
1	105
1/2	110
1/4	115

When the daily noise exposure is composed of two or more periods of noise exposure of different levels, the combined effects should be considered rather than the individual effect of each. Exposure to different levels for various periods of time shall be computed according to the following formula:

$$C_n = T_1 / L_1 + T_2 / L_2 + \dots + T_3 / L_3, \text{ where;}$$

C = combined noise exposure factor,

T = the total time of exposure at a specified sound-pressure level (in hours), and

L = the total time of exposure permitted at that level (in hours), from Table 5-3.

If  $C_n \geq 1$ , hearing protection is required.

05.C.03 Whenever sound-pressure levels equal or exceed 85 dBA (time weighted average), a continuing, effective hearing conservation program shall be administered in accordance with 29 CFR 1910.95: for DoD personnel the hearing conservation program shall conform to DODI 6055.12 and AR 40-5.

05.C.04 When sound-pressure levels exceed 115 dB(A) steady-state, personal ear protection equivalent to the combination of earplugs and earmuffs shall be required.

05.C.05 Sound-pressure level measurements shall be made by qualified personnel using calibrated instruments.

05.C.06 Ear insert devices shall be fitted to the exposed individual by an individual trained in such fitting and able to recognize the difference between a good and a poor fit: plain cotton is not an acceptable protective device.

05.C.07 Noise hazard areas (areas in which sound-pressure levels exceed the limits specified in paragraph 05.C.01) shall be marked with caution signs indicating both the presence of hazardous noise levels and the requirement for hearing protection.

## 05.D HEAD PROTECTION

05.D.01 All persons working in or visiting hard hat areas shall be provided with and required to wear Class A (low voltage electrical protection) or Class B (high voltage electrical protection) protective headgear.

a. Hard hat areas are those areas with potential hazard of head injury: all construction areas are considered hard hat areas. The identification and analysis of head hazards will be documented in a hazard analysis, accident prevention plan, or project safety and health plan, as appropriate.

b. Hard hat areas shall be general areas - such as dredging, construction, alteration, demolition, quarry, or similar field activities, rather than specific portions of a building or project.

c. All points of entry to a hard hat area shall have a sign warning of the requirement to wear hard hats.

05.D.02 All protective headgear shall meet the requirements of ANSI Z89.1.

a. No modification to the shell or suspension is allowed unless approved by the manufacturer.

b. Hard hats shall be worn with the bill facing forward.

c. Protective headgear worn near electric lines and equipment shall be Class B.

05.D.03 Protective headgear and components shall be visually inspected on a daily basis for signs of damage (dents, cracks, etc.) that might reduce the degree of safety originally provided; headgear will periodically be inspected for ultraviolet degradation as evidenced by cracking or flaking of the helmet.

05.D.04 Drilling holes or in any way changing the integrity of the hard hat is prohibited.

05.D.05 Protective headgear worn by USACE employees shall (in addition to complying with the preceding specifications) be:

a. White in color and marked with a 2.5 cm (1 in) band of red reflective material placed along the base of the crown with a 12.5 cm (5 in) break in front. A red Corps of Engineers castle insignia, meeting specifications of EP 385-1-6, will be centered at the front of the hat with the base of the insignia approximately 2 cm (3/4 in) above the base of the crown. Personnel may place their name above the insignia and their organization title below the insignia: the rank of military personnel should precede their name.

b. Local use of the sides of hard hats for safety decals is authorized.

c. Alterations that will reduce the dielectric or impact strength will not be made.

d. Requests for variations in color and marking to accommodate occupational specialties should be submitted for consideration to HQUSACE Safety and Health Office.

## 05.E RESPIRATORY PROTECTION

05.E.01 Whenever respiratory protective equipment, including military protective masks and emergency use self-rescuer devices, is required (see Section 6), employers shall develop and implement a respiratory protection program. The program shall be in accordance with the requirements contained in this section, the OSHA respirator standards, ANSI Z88.2, *NIOSH Respirator Decision Logic* (Department of Health and Human Services NIOSH Publication No. 87-108), and, for work around identified or suspected military chemical agent operations, AR 11-34. The requirements of these documents will be used in:

- a. the selection, fit testing, use, maintenance, and storage of respiratory protective equipment,
- b. the training of personnel required to use the respiratory protective equipment, and
- c. determining if employees are physically and medically determined qualified to wear respiratory protection devices.

05.E.02 Employers shall designate a competent person to develop, implement, and manage the written respiratory protection program. Qualifications of the competent person shall be submitted to the designated authority in the accident prevention plan or activity hazard analysis.

05.E.03 A competent person knowledgeable of inhalation hazards and respiratory protective equipment shall conduct a step-by-step evaluation to insure that only respiratory protection appropriate for the conditions of exposure is selected and utilized. Protection factors described in ANSI Z88.2 or other nationally recognized sources shall be used in the selection process.

05.E.04 The medical status of individuals who are required to wear respirators, to include the use of contact lenses, if applicable, shall be evaluated and a statement shall be provided from a qualified physician indicating that the individual is medically qualified to wear a specified type of respirator.

05.E.05 Respirators shall not be substituted for engineering or environmental control methods without approval of the designated authority.

05.E.06 Approved respiratory protective devices, suitable for their intended use, shall be provided by the employer and used to protect employees against exposure to respiratory hazards.

a. "Approved" means the respirator assembly (the respirator and all of its component parts) has been tested and listed as satisfactory according to standards established by a competent authority (such as NIOSH, MSHA, or host country agency) to provide respiratory protection against a particular hazard for which it was designed. For protection against chemical agent, the Departments of Defense and Army are the approval authorities (approval authority may be specified by law).

b. The respirator assembly approval number, criteria for use, and limitations will appear on the respirator assembly and/or its container.

05.E.07 When respirators are to be used, written standard operating procedures (SOPs) shall be developed and implemented. Respirator SOPs shall address specific requirements of ANSI Z88.2, including the following:

- a. selection of respirators based on hazard exposure;
- b. fit testing;
- c. user instruction in the proper use of respirators and their limitations;
- d. issuance of respirators;
- e. cleaning, disinfection, and storage of respirators;
- f. inspection of respirators;
- g. monitoring respiratory hazards and respirator use; and

h. planning for routine, nonroutine, emergency, and rescue uses of respirators.

05.E.08 A respirator equipped with a face piece shall not be worn if facial hair comes between the sealing surface of the face piece and the face, or if facial hair interferes with valve function.

05.E.09 The use (including conditions and medical clearance) or prohibition of wearing contact lenses with selected respirator types shall be determined.

05.E.10 If a spectacle, goggle, face shield, or welding helmet must be worn with a face piece, it shall be worn so as not to adversely affect the seal of the face piece to the face.

05.E.11 Respiratory devices using compressed gaseous air, compressed gaseous oxygen, liquid air, or liquid oxygen are prohibited unless approved before use by a qualified person.

- a. Compressed gaseous and liquid oxygen shall meet the requirements of the U.S. Pharmacopoeia for medical or breathing oxygen.
- b. Compressed or liquid air shall meet the requirements of the specification for Grade D breathing air (or better) as described in ANSI/CGA G-7.1, *American National Standard Commodity Specification for Air*.
- c. Compressed gaseous oxygen shall not be used in atmosphere-supplying respirators or in open-circuit self-contained breathing apparatuses that have previously used compressed air.
- d. Oxygen must never be used with supplied air respirators.

05.E.12 Breathing air may be supplied to respirators from cylinders or air compressors.

05.E.13 Before initial use, the quality of the breathing air supplied

from cylinders or compressors shall be tested for harmful contaminants in accordance with ANSI/CGA G-7.1. A copy of the certificate of analysis from a qualified source showing the breathing air meets the minimum acceptable criteria shall be provided to the designated authority. The frequency of such testing shall be in accordance with ANSI/CGA G-7.1 as a minimum and more frequently when deemed necessary by the user and/or the designated authority.

05.E.14 Breathing air containers shall be marked in accordance with ANSI Z48.1, Federal Specification BB-A-1034a, or interim Federal Specification GG-B-675d.

05.E.15 Cylinders shall be tested and maintained in accordance with applicable DOT specifications for shipping containers (49 CFR Parts 173 and 178).

05.E.16 Compressors.

- a. A compressor used to supply breathing air shall be constructed and situated to avoid entry of contaminated air into the air supply system.
- b. Breathing air-type compressors shall be designed specifically for their intended use and shall be equipped with an approved regulator, suitable in-line air purifying sorbent beds and filters inserted into the supply line to assure breathing air quality.
- c. Oil-lubricated compressors shall be equipped with high-temperature, equipment failure, and carbon monoxide continuous monitoring alarm systems. All alarm systems shall be so designed that affected employees will be made aware of the hazardous conditions. All systems shall be calibrated daily. A record of the results of the testing shall be maintained. (Alarms shall be of a type specifically designed for use in line with oil-lubricated compressors.)
- d. Oil-lubricated compressors will be equipped with required operational safety devices and reservoirs (or equivalent devices) with sufficient capacity to enable the respirator wearer to escape

from a contaminated atmosphere in case of equipment failure.

- e. When used with an air line continuous-flow type respirator, the compressor shall provide, for each user supplied from the compressor, at least 115 L (4 ft<sup>3</sup>) of air per minute for tight-fitting Face pieces and at least 170 L (6 ft<sup>3</sup>) of air per minute for loose-fitting types such as helmets, hoods, and suits.

05.E.17 Breathing air couplings shall be incompatible with outlets for non-respirable air or other gas systems to prevent inadvertent servicing of air line respirators with non-respirable gases or oxygen.

05.E.18 Canister and cartridge type air-purifying respirators may be used only under the following circumstances:

- a. the identity and concentration of the contaminant are known and have adequate sustained warning properties,
- b. the oxygen content of air is at least 19.5%,
- c. periodic air monitoring of the work area is conducted,
- d. the respirator assembly is approved for protection against the specific contaminants and concentration levels to be encountered, and
- e. the model of respirator to be used has been successfully fit tested on the wearer.

05.E.19 Atmosphere-supplying respirators.

- a. Supplied-air respirators or self-contained breathing apparatus shall be worn when concentrations of contaminants in the atmosphere are unknown or exceed limitations specified (by the manufacturer) for air-purifying respirators.
- b. Air line respirators shall be worn, as a minimum, in areas where the atmosphere is determined not to be immediately dangerous to life or health (IDLH) but where either of the following conditions exist:

(1) the contaminant is unknown or the requirement for using an air-purifying respirator cannot be met; or,

(2) abrasive blasting or spraying with or on harmful substances when the concentrations of those substances exceed the concentrations that can be safely handled by an air-purifying respirator.

- c. If air line respirators are used, the supplied air source shall not be capable of being expended and the hose length shall not exceed 90 m (300 ft) from source to user.

05.E.20 When planned for use in rescue operations, self-contained breathing apparatus shall be approved as described in 05.E.11.

05.E.21 IDLH atmospheres.

- a. Employees entering or working in atmospheres that are IDLH shall wear either a self-contained breathing apparatus of the pressure-demand type open-circuit or positive-pressure type closed-circuit, or a combination pressure-demand type air line respirator with an integral auxiliary self-contained air supply of at least 15 minutes.
- b. Employees shall be instructed and trained in the use of self-contained breathing apparatus before exposure to IDLH atmospheres.
- c. No employee shall enter an IDLH atmosphere unless accompanied by another adequately protected employee or wearing a safety line and safety harness tended by a person in a safe area. The tender shall have no other duties and shall have the proper equipment available to assist the respirator wearer(s) in case of emergency. An effective communication system that will provide rapid notification of emergency response needs shall be maintained.

05.E.22 Oxygen-deficient atmospheres. No person shall be permitted in atmospheres containing less than 19.5% oxygen without wearing a self-contained breathing apparatus of an approved type or a combination pressure-demand type air line

respirator with an integral axillary self-contained air supply of at least 15 minutes.

05.E.23 Use of respirators in permit required confined spaces.

- a. All permit required confined spaces shall be considered immediately dangerous to life or health (IDLH) until proven otherwise by testing. **> See also Section 6**
- b. The concentration of air contaminants and oxygen in the permit required confined space shall be monitored while personnel are inside the space.
- c. When sufficient ventilation cannot be obtained without blocking access, persons in a permit required confined space shall be protected by air line respirators or self-contained breathing apparatus.
- d. An air-purifying respirator may be worn by a person in a permit required confined space only if tests show that the atmosphere is not oxygen deficient and that the concentrations of air contaminants present are not IDLH and do not exceed the limitations of the respirator.
- e. An air line type or hose-mask type supplied air-respirator may be worn by a person in a permit required confined space only if tests show that the atmosphere is not oxygen deficient and only if tests show that concentrations of air contaminants are not IDLH.
- f. When the results of monitoring the atmosphere in a permit required confined space, before entry of a person into the space, show that the atmosphere is IDLH, the entrant shall wear either a positive-pressure self-contained breathing apparatus or a combination continuous-flow air line respirator with an auxiliary self-contained air supply of at least 15-minutes.
- g. An oxygen-type open-circuit self-contained breathing apparatus shall not be worn in a permit required confined space when the possibility of a fire or explosion hazard is thereby increased.

05.E.24 The use of respirators in low- and high-temperature environments shall be in accordance with the requirements of ANSI Z88.2.

**05.F BODY BELTS, HARNESSSES, LANYARDS, AND LIFELINES - SELECTION OF COMPONENTS**

05.F.01 Personal fall arrest and positioning device systems.

- a. Personal fall arrest systems require the use of body harnesses: body belts are not acceptable as part of personal fall arrest systems.
- b. The use of a body belt is permitted in a positioning device system.

05.F.02 Body belts and harnesses.

- a. Connectors shall be drop forged, pressed or formed steel, or made of equivalent materials; shall have corrosion resistant finish; and all surfaces and edges shall be smooth to prevent damage to interfacing parts of the system.
- b. D-rings, snaphooks, and other connectors shall have a minimum tensile strength of 2,270 kg (5,000 lbs); D-rings and snaphooks shall be proof-tested to a minimum tensile load of 1,600 kg (3,600 lbs) without cracking, breaking, or taking permanent deformation. **> Proof testing is typically conducted by the manufacturer, and a specification of proof testing supplied with the manufactured good**
- c. Body belt/harness systems shall decelerate and bring the employee to a complete stop within 1 m (42 in), excluding lifeline elongation, after free fall distance.
- d. Body belt/harness systems, when stopping or preventing a fall, shall not produce an arresting force on an employee of more than 10 times the employee's weight or 800 kg (1,800 lbs), whichever is lower.

- e. Body belts shall be at least 4 cm (1-5/8 in) wide.

05.F.03 Lifelines and lanyards.

- a. Lanyards and vertical lifelines shall have a minimum tensile strength of 2,270 kg (5,000 lbs).

- b. Horizontal lifelines shall be designed, installed, and used, under the supervision of a qualified person, as part of a complete personal fall arrest system, which maintains a factor of safety of at least two.

- c. Self-retracting lifelines and lanyards that automatically limit free fall distance to 60 cm (2 ft) or less shall be capable of sustaining a minimum tensile load of 1,360 kg (3,000 lbs) applied to the device with the lifeline or lanyard in the fully extended position. Self-retracting lifelines and lanyards that do not limit free fall distance to 60 cm (2 ft) or less, ripstitch lanyards, and tearing and deforming lanyards shall be capable of sustaining a minimum tensile load of 2,270 kg (5,000 lbs) applied to the device with the lifeline or lanyard in the fully extended position.

- d. Ropes and straps (webbing) used in lanyards, lifelines, and strength components of body belts and body harnesses shall be made from synthetic fibers.

05.F.04 Lineman's equipment.

- a. All fabric for safety straps shall be capable of withstanding an alternating current dielectric test of not less than 25,000 volts per foot "dry" for 3 minutes, without visible deterioration.
- b. All fabric and leather used shall be capable of being tested for leakage current and not exceed 1 milliamperes when a potential of 3,000 volts is applied to the electrodes 30 cm (12 in) apart.
- c. Direct current testing may be permitted in lieu of alternating current testing.

**05.G SAFETY AND DEBRIS NETS - DESIGN AND TESTING**

05.G.01 Design of safety nets.

- a. The maximum size of each safety net mesh opening shall not exceed 90 cm<sup>2</sup> (36 in<sup>2</sup>) square, nor be longer than 15 cm (6 in) on any side, and the opening - measured center-to-center of mesh ropes or webbing - shall not be longer than 15 cm (6 in). All mesh crossings shall be secured to prevent enlargement of the mesh opening.

- b. All new nets shall meet accepted performance standards of 17,500 foot-pounds minimum impact resistance as determined and certified by the manufacturer and shall bear a label of proof test.

- c. Each safety net (or section) shall have a border rope for webbing with a minimum breaking strength of 2,270 kg (5,000 lbs).

- d. Connections between safety net panels shall be as strong as integral net components and spaced not more than 15 cm (6 in) apart.

05.G.02 Testing of safety nets.

- a. Safety nets and safety net installations shall be tested in the suspended position immediately after installation and before being used as a fall protection system, whenever relocated, after major repair, and, when left at one location, at not more than six month intervals.
- b. The test shall consist of dropping into the net a 180 kg (400 lb) bag of sand, not more than 75 cm +/- 5 cm (30 in +/- 2 in) in diameter, at least 1 m (42 in) above the highest working/- walking surface at which employees are exposed to fall hazards.
- c. Defective nets shall not be used.

05.G.03 Design of debris nets.

- a. Debris nets shall be constructed of wire or synthetic netting of not more than 25 mm (1 in) mesh.
- b. Wire mesh shall be made of not less than 22-gage wire and synthetic mesh of not less than Number 18 twine.

**05.H ELECTRICAL PROTECTIVE EQUIPMENT**

05.H.01 Persons working on electrical distribution systems shall be provided with the appropriate electrical protective equipment, which shall be inspected, tested, and maintained in safe condition in accordance with the standards referenced in Table 5-4.

05.H.02 Electrical workers' rubber insulating protective equipment shall be visually inspected for damage and defects before use.

**TABLE 5-4**

**STANDARDS FOR ELECTRICAL PROTECTIVE EQUIPMENT**

Head protection - ANSI Z89.1, <i>Protective Headwear for Industrial Workers</i>
Eye and face protection - ANSI Z87.1, <i>Practice for Occupational and Educational Eye and Face Protection</i>
Blankets - ANSI/ASTM F479, <i>In-service Care of Insulating Blankets</i>
Line hose and covers - ANSI/ASTM F478, <i>In-service Care of Insulating Line Hose and Covers</i>
Sleeves - ANSI/ASTM F496, <i>In-service Care of Insulating Gloves and Sleeves</i>
Gloves - ANSI/ASTM F496, <i>In-service Care of Insulating Gloves and Sleeves</i> ; ANSI/ASTM F696, <i>Leather Protectors for Rubber Insulating Gloves and Mittens</i>
Footwear - ANSI Z41, <i>Protective Footwear</i>

05.H.03 An air test shall be performed on electrical workers' rubber insulating gloves before use each day.

05.H.04 Protective equipment of material other than rubber shall provide equal or better electrical and mechanical protection.

05.H.05 Only live-line tool poles having a manufacturer's certification to withstand at least the following tests shall be used:

- a. 100,000 volts per foot of length for 5 minutes when the tool is made of fiberglass, or
- b. 75,000 volts per foot of length for 3 minutes when the tool is made of wood, or
- c. other equivalent tests.

05.H.06 Only tools and equipment intended for live-line barehand work shall be used on transmission lines. The tools shall be kept dry and clean and shall be visually inspected before use each day.

05.H.07 See Section 05.F for requirements on lineman's personal fall protection equipment.

**05.I PERSONAL FLOATATION DEVICES**

05.I.01 Type III, Type V, or better U.S. Coast Guard approved International Orange personal floatation device (PFD) shall be provided to and properly worn by all persons in the following circumstances: **> See Figure 5-1**

- a. on floating pipelines, pontoons, rafts, or stages;
- b. on structures extending over or next to water except where guardrails or safety nets are provided for employees;
- c. working alone at night where there are drowning hazards, regardless of other safeguards provided;
- d. in skiffs, small boats, or launches, unless in an inclosed cabin or cockpit; or
- e. wherever there is a drowning hazard.

05.I.02 Before and after each use, the PFD shall be inspected

for defects that would alter its strength or buoyancy: defective devices or devices with less than 6 kg (13 lbs) buoyancy shall be removed from service.

#### 05.I.03 Reflective tape and PFD lights.

- a. All PFDs shall be equipped with retroreflective tape as specified in 46 CFR 25.25-15.
- b. PFDs provided on vessels used on the Great Lakes, Western Rivers, coastwise, or ocean service shall be equipped with PFD lights in accordance with 46 CFR 25.25-13 (work vests are exempt from the lighting requirement if an approved Type I PFD or immersion suit is available for the employee on board).
- c. PFD lights conforming to 46 CFR 161.012 shall be required whenever there is potential need for life rings to be used after dark. On shore installations, at least one life ring, and every third one thereafter, shall have a PFD light attached. PFD lights on life rings are required only in locations where adequate general lighting (e.g., floodlights, light stanchions) is not provided.
- d. On Coast Guard certified vessels, PFDs are required to have automatic floating electric water lights as required by 46 CFR 161.010: on all other floating plant, at least one life ring, and every third one thereafter, shall have an automatic floating electric water light attached.

05.I.04 Throwable devices (Type IV PFD). Liferings (rope attachment not required) and ring buoys (rope attachment required) shall conform to the requirements of 46 CFR 160 (U.S. Coast Guard approved) and should have at least 21 m (70 ft) of 1 cm (3/8 in) solid braid polypropylene, or equivalent, attached. Throw bags may be used in addition to life rings or ring buoys. Life rings or ring buoys shall be readily available and shall be provided at the following places:

- a. at least one on each safety skiff;
- b. at least one on all motor boats up to 12 m (40 ft) in length

and at least two for motor boats 12 m (40 ft) in length or longer;

- c. at least two on any other piece or group of floating plant up to 30 m (100 ft) in length and one additional for each increase in length of 30 m (100 ft) or fraction thereof; and
- d. at least one at intervals of not more than 60 m (200 ft) on pipelines, walkways, wharves, piers, bulkheads, lock walls, scaffolds, platforms, and similar structures extending over or immediately next to water, unless the fall distance to the water is more than 14 m (45 ft), in which case a life ring shall be used. (The length of line for life rings at these locations shall be evaluated but may not be less than 21 m (70 ft).)

05.I.05 At navigation locks, an analysis of the benefits versus the hazards of using floating safety blocks (blocks that may be quickly pushed into the water to protect individuals who have fallen in the water from being crushed by vessels) shall be made.

- a. This analysis shall be documented as an activity hazard analysis.
- b. If the use of blocks is found acceptable, consideration shall be given to the size and placement of the blocks, the appropriate means of securing and signing the blocks, etc. When the use of blocks is found unacceptable, alternative safety measures shall be developed.

#### 05.J LIFESAVING AND SAFETY SKIFFS

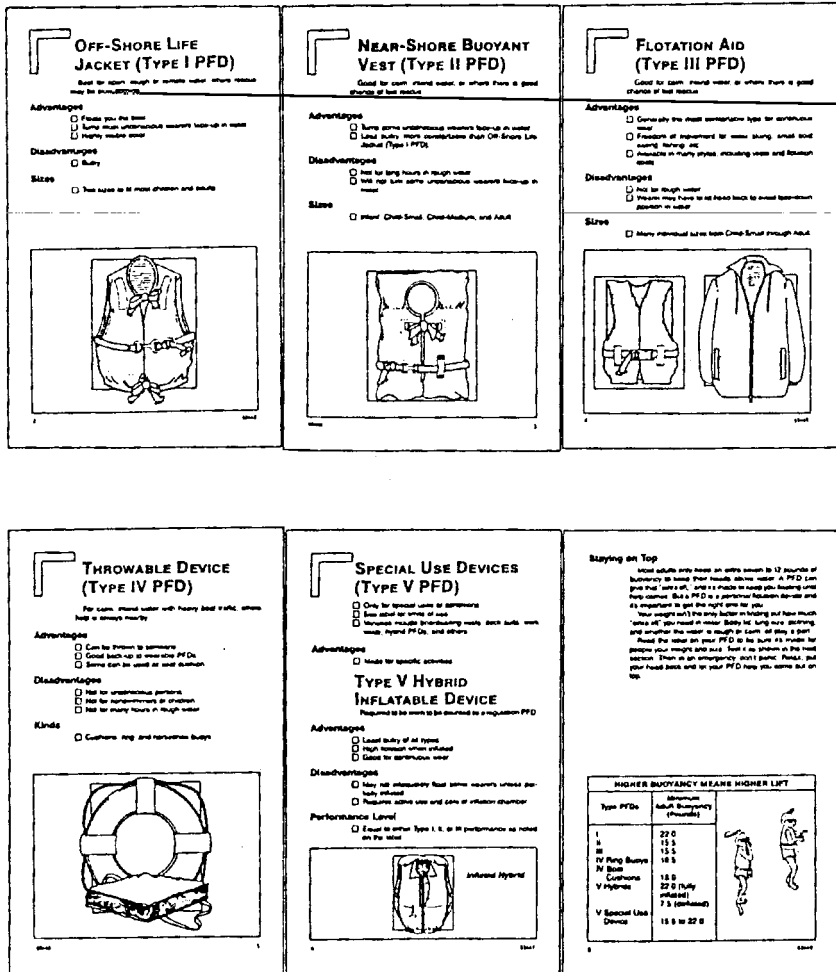
05.J.01 At least one skiff shall be immediately available at locations where employees work over or immediately next to water.

05.J.02 Personnel trained in launching and operating the skiff shall be readily available during working hours. Lifesaving personnel shall perform a lifesaving drill before the initiation of work at the site and periodically thereafter as specified by the designated authority (but at least monthly or whenever new personnel are involved).

05.J.03 Skiffs shall be kept afloat or ready for instant launching.

FIGURE 5-1

PERSONAL FLOTATION DEVICES



05.J.04 Required equipment must be on board and meet or exceed U.S. Coast Guard requirements and the requirements of Section 19 of this manual. Skiffs shall be equipped as follows:

- four oars (two if the skiff is motor powered);
- oarlocks attached to gunwales or the oars;
- one ball-pointed boat hook;
- one ring buoy with 21 m (70 ft) of 1 cm (3/8-in) solid braid polypropylene, or equivalent, line attached; and
- PFD's in number equaling the skiff rating for the maximum number of personnel allowed on board.

05.J.05 In locations where waters are rough, swift, or where manually-operated boats are not practical, a power boat suitable for the waters shall be provided and equipped for lifesaving.

05.J.06 Skiffs and power boats shall have flotation tanks or buoyant material capable of floating the boat and its equipment and the crew.

05.J.07 On vessels (e.g., skiffs) without permanently mounted navigation lights, portable battery-operated navigation lights will be available and used for night operations.

DEFINITIONS

Decelerating device: any mechanism which serves to dissipate energy during a fall.

Decibel (dB): a measure of sound pressure.

dB(A): a weighted measure of sound pressure used with sound level meters; the weighting causes the sensitivity of the sound level meter to vary with the frequency and intensity of sound and in doing so duplicates the response of the human ear.

Demand-type respirator: a respirator equipped with a demand valve which is activated on initiation of inhalation and permits the flow of breathing atmosphere to the face piece; on exhalation, pressure in the facepiece becomes positive and the demand

valve is deactivated.

Facepiece: that portion of a respirator that covers the wearer's nose and mouth in a quarter- or half-mask facepiece, or nose, mouth, and eyes in a full facepiece.

Immediately dangerous to life or health: any atmosphere that poses an immediate hazard to life or produces immediate irreversible debilitating effects on health; any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects.

Impulse noise: noise is considered impulse when the variations in sound-pressure level involve peaks at intervals greater than one second.

Lanyard: a flexible line which is used to secure a safety belt or harness to a lifeline or directly to a point of anchorage.

Lifeline: a line (horizontal or vertical) for direct attachment between a worker's personal fall protection device and a point of anchorage.

Live-line bare-hand technique: a highly specialized technique (usually used on medium and high-voltage transmission lines) where a qualified employee working from an insulated aerial platform is electrically bonded to an energized line, effectively canceling any electrical potential difference across the worker's body and protecting the employee from electric shock.

Live-line tools: tools used by qualified employees to handle energized conductors. The tool insulates the employee from the energized line, allowing the employee to perform the task safely. Also known as "hot sticks."

Negative-pressure respirator: a respirator in which the air pressure (in relation to the air pressure of the outside atmosphere) inside the respiratory-inlet covering is positive during exhalation and negative during inhalation.

Oxygen deficient atmosphere: an atmosphere having an oxygen

concentration of less than 19.5% by volume.

Point of anchorage: a secure point of attachment for lifelines, lanyards, or deceleration devices.

Positive-pressure respirator: a respirator in which the air pressure (in relation to the air pressure of the outside atmosphere) inside the respiratory-inlet covering is positive during both exhalation and inhalation.

Pressure-demand type respirator: a respirator in which the pressure (in relation to the immediate environment) inside the facepiece is positive during both inhalation and exhalation.

Radiant energy: the energy of electromagnetic waves produced by movement of molecules excited by the heat of an electric arc, gas flame, or the passage of electric current. Includes ultraviolet, visible light, and infrared energy.

Respirator: a device designed to protect the wearer from the inhalation of harmful atmospheres.

Safety belt: a strap, with means for securing about the waist and attaching to a lanyard, lifeline, or decelerating device, which is used to limit the fall of a worker.

Safety harness: a design of straps which is secured about the employee in a manner to distribute the arresting forces over at least the thighs, shoulders, and pelvis, with provisions for attachment to a lanyard, lifeline, or decelerating device.

Snaphook: a connector consisting of a hook-shaped member with a normally closed keeper, or similar arrangement, which may be opened to permit the hook to receive an object and, when released, automatically closes to retain the object.

The locking type has a self-closing, self-locking keeper which remains locked until unlocked and pressed open for connection or disconnection.

The non-locking type has a self-closing keeper which remains closed until pressed open for connection or disconnection.

Sound pressure, steady-state: sound that does not significantly change in intensity or frequency with time.

## SECTION 6

### HAZARDOUS SUBSTANCES, AGENTS AND ENVIRONMENTS

#### 06.A GENERAL

##### 06.A.01 Exposure standards.

- a. Exposure, through inhalation, ingestion, skin absorption, or physical contact, to any chemical, biological, or physical agent in excess of the acceptable limits specified in the ACGIH "*Threshold Limit Values and Biological Exposure Indices*" shall be prohibited.
- b. In case of conflicts between ACGIH and other standards or regulations referenced in this manual, the more stringent shall prevail.
- c. The employer shall comply with all applicable standards and regulations to reduce contaminant concentration levels as low as is reasonably achievable (ALARA).

##### 06.A.02 Hazard evaluation.

- a. All operations, materials, and equipment shall be evaluated to determine the presence of hazardous environments or if hazardous or toxic agents could be released into the work environment.
- b. Activity and/or position hazard analyses shall be used for the evaluation. The analyses shall identify all substances, agents, and environments that present a hazard and recommend hazard control measures. Engineering and administrative controls shall be used to control hazards; in cases where engineering or administrative controls are not feasible, PPE may be used.
- c. The analyses shall identify: that it serves as certification of hazard assessment; the workplace and activity evaluated;